



Bacteria and Benthic TMDLs in Occoquan Watershed Stream Segments

First TAC Meeting

March 1, 2005



Overview of Presentation

- I. Provide background on water quality assessment and the impaired waters listing process
- II. Discuss the Occoquan Streams impairments to be addressed in this TMDL study
- III. Provide overview of the TMDL process

I. Background on water quality assessment and the impaired waters listing process

305(b) Assessment and 303(d) Listing Processes

- Monitor and assess water quality for 305(b) Report
- Place any waters not meeting Water Quality Standards on 303(d) List
- Develop TMDL for each listed water
- Develop TMDL Implementation Plan (IP)
- Implement TMDL in stages, and monitor to detect resulting improvements in water quality



Water Quality Standards

**Listing of impaired waters
and TMDL development
are based on
Water Quality Standards (WQS)**

Water Quality Standards

Water Quality Standards (WQS) are regulations based on federal and state law that:

- set **numeric** and **narrative** limits on pollutants
- consist of **designated use(s)** and water quality **criteria**

Water Quality Standards

Purpose of WQS:

- **protection** of the designated uses of state waters
 - aquatic life
 - fishing
 - shellfish
 - swimming
 - drinking water
- **restoration** of state waters (TMDLs)

Applicable Designated Uses

All surface waters in Virginia are currently designated for **primary contact recreation** (e.g. swimming) and **aquatic life use**

- For primary contact recreation use, waters are assessed using fecal coliform and *E. coli* bacteria measurements
- For aquatic life use, waters are assessed using various water quality data measures and biological monitoring

Assessment Methodology: Recreation

Fecal coliform bacteria and E. coli bacteria

- **Fecal bacteria** are found in the digestive tract of humans and warm blooded animals
- Fecal bacteria are an indicator of the potential **presence of pathogens** in waterbodies
- The presence of fecal bacteria in water samples is a strong indicator of recent **sewage or animal waste contamination**

Assessment Methodology: Recreation

Fecal coliform bacteria and E. coli bacteria

Indicator species for freshwater: *E. coli*

- Change in indicator species - from fecal coliform to *E. coli* (fresh water)
- *E. coli* bacteria are a **subset of fecal coliform** bacteria and correlate better with swimming-associated illness

Summary of Changes in Primary Contact Criteria

Indicator	Status	Instantaneous Maximum (cfu/100mL)	Geometric Mean (cfu/100 mL)
Fecal Coliform	Old	1,000	200
<i>E. coli</i>	New	235	126
Fecal Coliform	Interim	400	200

- Changes went into effect on January 15, 2003
- Both New *E. coli* and Interim Fecal Coliform criteria apply
- Fecal coliform criteria will be phased out entirely once 12 *E. coli* samples have been collected or after June 30, 2008

Assessment Methodology: Aquatic Life/ Benthic Impairments

- Based on benthic macroinvertebrate biological monitoring data
- Follows EPA Rapid Bioassessment Protocols (RBPII)
- Later ongoing monitoring will transition to Streams Condition Index (SCI) once this methodology is approved

II. The Occoquan Streams TMDL

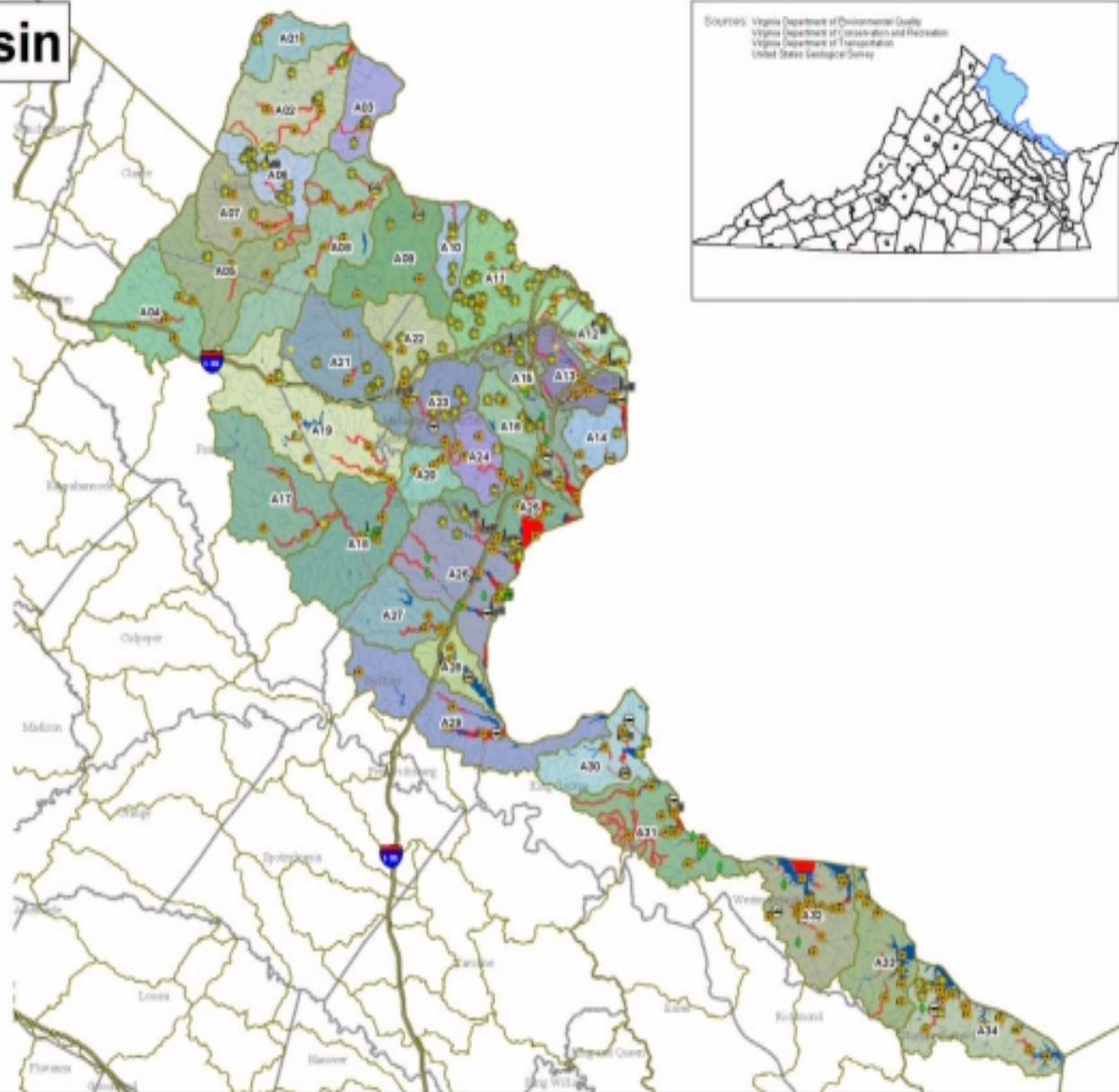
Potomac River Basin

Monitoring Stations

- Ambient
- Ambient/Biological
- Ambient/Biological/Fish Tissue
- Ambient/Federal
- Ambient/Federal/Fish Tissue
- Ambient/Fish Tissue
- Biological
- Biological/Fish Tissue
- Citizen Monitoring
- Federal
- Fish Tissue

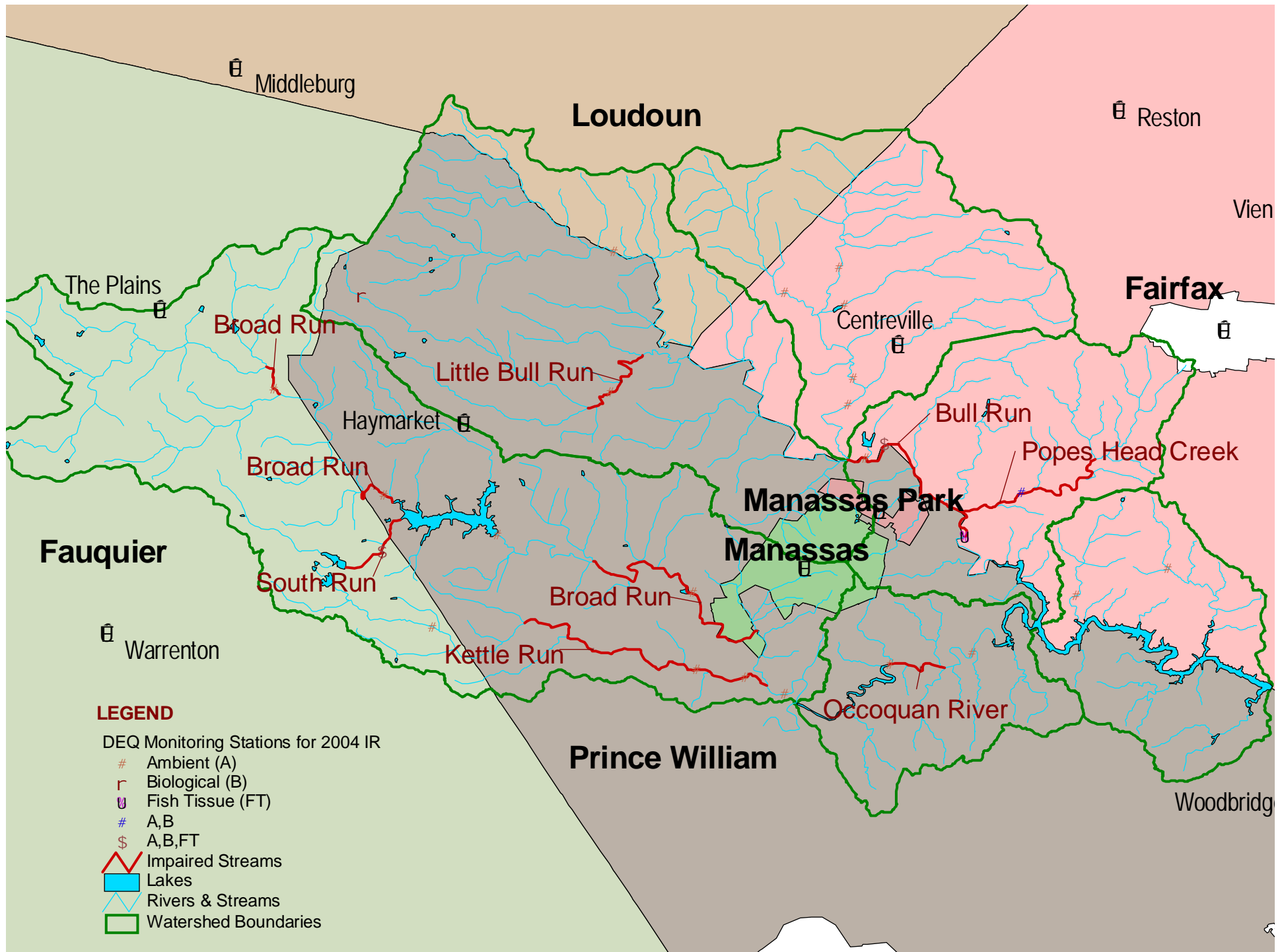
NPDES Dischargers

- Industrial
- Municipal
- Interstate
- Watersheds
- Impaired Rivers and Streams
- Impaired Reservoirs and Estuaries



Sources: Virginia Department of Environmental Quality
Virginia Department of Conservation and Recreation
Virginia Department of Transportation
United States Geological Survey





Impairments in the Upper Occoquan Watershed

WATERBODY ID	Stream	County/City	Length (mi.)	Year Listed	Impairment
VAN-A19R	Broad Run	Prince William	1.51	2002	Bacteria
VAN-A19R	Broad Run	Prince William	7.26	2002	Bacteria
VAN-A19R	Broad Run	Prince William	1.06	2004	Bacteria
VAN-A19R	South Run	Fauquier, Prince William	2.34	2004	Bacteria
			2.34	1996	Benthic
VAN-A19R	Kettle Run	Prince William	7.59	2002	Bacteria
VAN-A20R	Occoquan River	Prince William	1.61	2004	Bacteria
VAN-A21R	Little Bull Run	Prince William	3.03	2004	Bacteria
VAN-A23R	Bull Run	Prince William, Fairfax	4.8	2004	Bacteria
			15.64	1996	Benthic
VAN-A23R	Popes Head Creek	Fairfax	4.92	2004	Bacteria
			4.92	1998	Benthic

Occoquan Streams

2004 Water Quality Assessment

Results for Bacteria

TMDL_ID	WB_NAME	Monitoring Station	Location	Fecal Coliform	
				Exceedences/Samples	%
VAN-A19R-01	Broad Run	1ABRU001.59	Rte. 692	1/ 6	16.7%
VAN-A19R-02	Broad Run	1ABRU007.58	Rte. 28	4/ 19	21.1%
VAN-A19R-02	Broad Run	1ABRU020.12	Rte. 29/15	7/ 18	38.9%
VAN-A19R-05	Broad Run	1ABRU024.74	Rte. 628	2/ 5	40.0%
VAN-A19R-03	Kettle Run	1AKET000.80	Rte. 619	8/ 20	40.0%
VAN-A19R-03	Kettle Run	1AKET002.06	Rte. 611	1/ 5	20.0%
VAN-A19R-04	South Run	1ASOT001.44	Rte. 215	5/ 18	27.8%
VAN-A20R-01	Occoquan River	1AOCC024.74	Rte. 234	4/ 16	25.0%
VAN-A21R-01	Little Bull Run	1ALII003.97	Rte. 705	2/ 17	11.8%
VAN-A23R-01	Bull Run	1ABUL010.28	Rte. 28	4/ 34	11.8%
VAN-A23R-02	Popes Head Creek	1APOE002.00	Rte. 645	3/ 20	15.0%

A greater than 10.5% exceedance rate with a minimum of two sampling events results in an impairment listing.

Occoquan Streams Benthic Impairments

- The three benthic-impaired streams have been under ongoing biological monitoring
 - South Run and Bull Run 1994-2000, 2004→
 - Popes Head Creek 1997-2000, 2004→
- South Run and Bull Run First listed in 1996. Popes Head Creek first listed in 1998.
- Reference sites
 - Catoctin Creek used for South Run and Popes Head Creek
 - Rapidan River used for Bull Run

III. Overview of the TMDL process

Virginia TMDLs

- Clean Water Act §303(d) and 40 CFR §130.7 requires development of TMDLs
- In 1999, EPA signed a Consent Decree with lawsuit Plaintiffs, agreeing to develop TMDLs in Virginia
- VDEQ is required to develop TMDLs and Implementation Plans (IPs) under state statute (**Water Quality Monitoring, Information, and Restoration Act - WQMIRA**)

What is a TMDL ?

Total Maximum Daily Load

A TMDL is a **pollution budget**:

$$\text{TMDL} = \text{Sum of WLA} + \text{Sum of LA} + \text{MOS}$$

Where:

TMDL = Total Maximum Daily Load

WLA = Waste Load Allocation (point sources)

LA = Load Allocation (nonpoint sources)

MOS = Margin of Safety

Required Elements of a TMDL

A TMDL must:

- be developed to meet Water Quality Standards
- be developed for critical stream conditions
- consider seasonal variations
- consider impacts of background contributions
- include wasteload and load allocations (WLA, LA)
- include a margin of safety (MOS)
- be subject to public participation
- provide reasonable assurance of implementation

TMDL Development Methodology

- Identify all types of sources of a given pollutant within the watershed
- Calculate the amount of pollutant entering the stream from each source type
- Calculate the pollutant reductions needed, by source, to attain Water Quality Standards
- Allocate the allowable loading to each source and include a margin of safety

Ongoing Monitoring in Support of TMDL Process

Wtrshd	Station ID	Stream	Location	Monitoring Yr	Parameters
A 19R	1ABRU001.59	Broad Run	Rt. #692	2003-2004	FC, e coli
A 19R	1ABRU011.24	Broad Run	Sudley Manor Dr.	2003-2004	BST, FC, e coli
A 19R	1ABRU020.12	Broad Run	Rt. 29/15	2003-2004	BST, FC, e coli
A 19R	1ABRU029.80	Broad Run	Rt. 55	2003-2004	FC, e coli
A 19R	1AKET002.06	Kettle Run	Rt. 611	2003-2004	BST
A 19R	1AKET012.03	Kettle Run	Rt. 761	2003-2004	FC, e coli
A 19R	1ATRA001.02	Trapp Branch	Rt. 674	2003-2004	FC, e coli
A 19R	1ASOT001.65	South Run	Rt. 652	2003-2004	FC, e coli
A 19R	1ABRU026.40	Broad Run	Rt. 628	2004-2005	BST, FC, e coli
A 19R	1ASOT001.65*	South Run	Rt. 652	2004-2005	BST, FC, e coli
A 20R	1AOCC021.35*	Occoquan River	Rt. #3000	2004-2005	BST, FC, e coli
A 21R	1ALII003.97	Little Bull Run	Rt. # 705	2004-2005	BST, FC, e coli
A 23R	1ABUL010.28	Bull Run	Rt. 28	2004-2005	FC, e coli
A 23R	1APOE002.00	Popes Head Creek	Rt. #645	2004-2005	BST, FC, e coli
A 23R	1ABUL010.28	Bull Run	Rt. 28	2004-2005	BST, FC, e coli
A 19R	1ASOT001.44	South Run	Rt. #652	2004	Biological, Nutrients, Toxics, Metals
A 23R	1ABUL010.28	Bull Run	Rt. #28	2003-2004	Biological, Nutrients, Toxics
A 21R	1ABUL025.94	Bull Run	Rt. #705	2004	Biological
A 23R	1APOE002.00	Popes Head Creek	Rt. # 645	2004	Biological, Nutrients, Toxics

Roles of DEQ and DCR in TMDL Development

- DEQ is the lead for TMDL development
- DEQ is responsible for ensuring public participation and submitting TMDLs to EPA for approval
- DCR is the lead for nonpoint source TMDL Implementation Plans and implementation (including MS4 permits)

Role of Technical Advisory Committee in TMDL Development

- TACs are asked to provide technical input and guidance to the process
- Requested to:
 - review data, methods, processes
 - advise of technical issues
 - assist with public outreach process

Bacteria and Benthic TMDLs in Occoquan Watershed Stream Segments

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Previous Bacteria Standard

Indicator species: fecal coliform

Instantaneous max:

1,000 cfu/100 mL

- Applicable for data sets with 1 or fewer samples in 30 days
- Used in **water quality assessment** because monitoring is usually conducted bimonthly

Geometric mean:

200 cfu/100 mL

- Applicable for data sets with 2 or more samples in 30 days
- Used in **TMDL development** because model output is usually daily

Interim Bacteria Standard

New fecal coliform criteria:

- interim criteria necessary for transition from fecal coliform to *E. coli*
- will be phased out when 12 *E. coli* observations available or after June 30, 2008

Instantaneous max:

400 cfu/100 mL

Applicable for all data sets; no more than 10% of samples in a calendar month may exceed the maximum

Geometric mean:

200 cfu/100 mL

Applicable for data sets with 2 or more samples in a calendar month

Applicable Bacteria Standard

New indicator species: *E. coli*

Instantaneous max:

235 cfu/100 mL

Applicable for all data sets; no samples may exceed the maximum

Geometric mean:

126 cfu/100 mL

Applicable for data sets with 2 or more samples in a calendar month